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UNITED STATES PATENT AND TRADEMARK OFFICE

Re:	Application of:	Jouni RAHKOMAA et al.
	Serial No.:	Not yet known
	Filed:	Simultaneously
	For:	**EQUIPMENT AND METHOD IN A PAPER OR BOARD MACHINE FOR MIXING OF FRESH STOCK AND OF WATER FOR DILUTION OF FRESH STOCK**

LETTER RE PRIORITY

Assistant Commissioner for Patents
Washington, DC 20231-9998

December 5, 2000

Dear Sir:

Applicant hereby claims the priority of Finnish Patent Application No. 981286 filed June 5, 1998 through International Patent Application No. PCT/FI99/00458 filed May 27, 1999.

Respectfully submitted,

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E T U O I K E U S T O D I S T U S
P R I O R I T Y D O C U M E N T

Hakija Applicant	VALMET CORPORATION Helsinki
Patenttihakemus nro Patent application no	981286
Tekemispäivä Filing date	05.06.98
Kansainvälinen luokka International class	D 21F

Keksinnön nimitys
Title of invention

Laitteisto ja menetelmä viiraveden ja tuoremassan sekoittamiseksi viirakaivon jälkeisessä kanavassa"

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Pirjo Kaila
Tutkimussihteeri

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Laitteisto ja menetelmä viiraveden ja tuoremassan sekoittamiseksi viirakaivon jälkeisessä kanavassa
Anläggning och förfarande för att blanda viravatten och färskmassa i en kanal efter virabrunnen

Keksinnön kohteena on laitteisto ja menetelmä viiraveden ja tuoremassan sekoittamiseksi viirakaivon jälkeisessä kanavassa.

Tekniikan tasosta tunnetaan laiteratkaisu, jossa viirakaivon jälkeiseen kapenevaan kanavaan johdetaan tuoremassa ja palautuskierto. Olennaista järjestelmässä on tuoremassan, viiraveden ja palautuskierron hyvä sekoittuminen.

Pyrittäessä viiraveden ja tuoremassan hyvään sekoittumiseen ehdotetaan tässä hakemuksessa, että siinä kohdalla viirakaivon jälkeisessä kanavassa, johon tuoremassa tuodaan, käsittää ainakin yksi kanava pinnallaan virtauskanavan pitkittäisakseliin nähden kohtisuorassa poikkileikkauksessa aaltomaisen kanavamuodon. Kyseinen aaltomainen kanavamuoto aikaansaa virtaukseen sekundääripyörteitä, jotka johtavat virtausten tehokkaaseen sekoittumiseen.

Keksinnön mukaiselle laitteistolle on tunnusomaista, että viirakaivosta johdetun viiraveden sekä putkesta johdetun tuoremassan sekoituskohdassa on ainakin yksi sellainen putkiosuus, joka käsittää yhteydessään putken poikkileikkauksessa aaltomaisen muodon.

Keksinnön mukaiselle menetelmälle on tunnusomaista, että viirakaivosta johdetun viiraveden sekä putkesta johdetun tuoremassan sekoituskohdassa on ainakin yksi sellainen putkiosuus, jossa muodostetaan sekundääripyörteitä, jotka aikaansaadaan aaltomaisella putken pintamuodolla.

Keksintöä selostetaan seuraavassa viittaamalla oheisien piirustuksien kuvioissa esitettyihin keksinnön eräisiin edullisiin suoritusmuotoihin, joihin keksintöä ei ole tarkoitus kuitenkaan yksinomaan rajoittaa.

Kuviossa 1A on esitetty periaatteellisesti paperikoneen/kartonkikoneen lyhyt kierto, jossa retentiona otettua viiravettä johdetaan viirakaivoon ja jonka viirakaivon pohjalta viiravettä johdetaan takaisinkiertona perälaatikkoon.

Kuviossa 1B on esitetty suurennetussa mittakaavassa keksinnön mukainen laitejärjestely, jossa viirakaivon pohjaosasta johdetun viiraveden yhteyteen johdetaan massan ja palautuskierron syöttöputket.

Kuviossa 2A on esitetty keksinnön ensimmäinen suoritusmuoto, jossa aaltomainen muoto on muodostettu viirakaivoon liittyvän putken 11 sisäseinämään.

Kuviossa 2B on esitetty leikkaus I - I kuviosta 2A.

Kuviossa 3A on esitetty keksinnön toinen suoritusmuoto, jossa aallotus on muodostettu putken 12 sisällä vietyyn putkeen 13.

Kuviossa 3B on esitetty leikkaus II - II kuviosta 3A.

Kuviossa 4A on esitetty keksinnön suoritusmuoto, jossa aaltomainen muoto on muodostettu putkeen 12.

Kuviossa 4B on esitetty leikkaus III - III kuviosta 4A.

Kuviossa 1A on esitetty periaatteellisesti viiravesikaivon käyttö retentiovesien keräämisessä sekä kuitupitoisen viiraveden uudelleen hyväksikäytössä, jolloin tuoremassa M ja palautuskierron vesi O johdetaan viiraveden V yhteyteen ja jossa rakenteessa edelleen yhdistynyt sekoittunut virtaus johdetaan viirakaivosta 10 paperikoneen tai kartonkikoneen

perälaatikon 100 yhteyteen. Kuviossa 1A esitetysti viiralta johdetaan viiravedet viirakaivoon 10. Viirakaivon 10 pohjalla olevaan kanavaan 11 paitsi viirakaivon 10 viiravettä V niin myös palautuskierron vesi O säiliöstä F että tuoremassa M massasäiliöstä S. Pumpun P avulla johdetaan yhdistynyt virtaus $L_1 + L_2 + L_3$ edelleen perälaatikolle 100.

Viirakaivon pohjalla sekoitetaan viiraveteen keksinnön mukaisesti tuoremassa ja palautuskierron vesi, joka on esim. perälaatikon ohikierto tai pyörrepuhdistuksen 2.vaiheen aksepti. Sakeusjärjestys on seuraava. Sakeinta on sakeamassa. Seuraavaksi sakeinta on palautuskierron vesi ja vähiten sakeinta on viiravesi (viivavesi < palautuskierto < sakeamassa).

Kuviossa 1B on esitetty keksinnön mukainen laitteisto, jossa nuolella L_1 esitetysti viiravesikaivosta 10 kuitupitoinen vesi johdetaan takaisin kiertoon putkeen 11. Putkeen 11 johdetaan myös tuoremassa M putkesta 13 sekä palautuskierron vesi O putkesta 12. Putki 12 on johdettu putken 11 sisälle kohdassa, jossa putki 11 kaareutuu ja virtauspoikkipinta-alaltaan kapenee. Putken 12 kautta johdetaan (nuoli L_2) palautuskierto eli palautuskierron vesi O viiraveden V yhteyteen. Putken 12 sisäpuolella keskeisesti sijaitsee putki 13. Putki 13 on johdettu koaksiaalisesti eli sama-akselisesti putken 12 sisällä. Putken 13 kautta johdetaan (nuoli L_3) tuoremassa M palautuskierron veden O ja viiravesikaivosta 10 johdetun viiraveden V yhteyteen. Näin ollen putken 11 kapenevassa virtaustiessä kohdassa K sekoitetaan massa M, palautuskiertovesi O sekä viiravesi V. Pumppu P kuviossa esitetysti aikaansaa imun putkeen 11 ja pumpun P avulla johdetaan komponenttien V, M, O yhdistynyt virtaus $L_1 + L_2 + L_3$ eteenpäin paperikoneen/kartonkikoneen perälaatikon 100 yhteyteen.

Jotta massan M ja palautuskierron veden O sekä viiraveden V sekoittuminen olisi mahdollisimman tehokasta ja täydellistä, on virtausten L_1, L_2 ja L_3 sekoituskohdalta K ainakin jokin putkista 11, 12 tai 13 varustettu aaltomaisella pintamuodolla virtauskanavan pitkittäisakseliin nähden kohtisuorassa poikkileikkauksessa. Kyseinen aaltomai-

nen pintamuoto aikaansaa ns. sekundääripyörteitä, jotka edesauttavat virtausten L_1, L_2 ja L_3 sekoittumista.

Kuviossa 2A on esitetty pitkittäispoikkileikkaus sekoituskohdasta K ja keksinnön ensimmäisestä edullisesta suoritusmuodosta. Kuviossa 2B on esitetty leikkaus I - I kuviosta 2A. Kuvioissa 2A ja 2B on esitetty suoritusmuoto, jossa putki 11 on varustettu ulkokehältään kiilamaisesti kapenevilla putken 11 sisäpinnan muotokappaleilla a_1, a_2, a_3..., jotka edelleen on siten muotoiltu, että poikkileikkauksessa esitetysti aaltomaisuuden aikaansaavan kiilaosan a_1, a_2, a_3... maksimikorkeus kiilaosan a_1, a_2... keskellä on palautuskierron vettä O johtavan putken 12 päädyssä. Massaa M johtava putki 13 ulkonee edelleen putken 12 sisältä.

Kuviossa 3A on esitetty pitkittäispoikkileikkaus keksinnön toisesta suoritusmuodosta. Kuviossa 3B on esitetty leikkaus II - II kuviosta 3A.

Kuvioissa 3A ja 3B esitetyssä suoritusmuodossa aaltomaisuus on muodostettu putken 12 sisällä olevaan keskeiseen putkeen 13. Putki 13 ulkonee putkesta 12. Näin ollen toisiopyörteitä aikaansaadaan sekä palautuskierron veden O virtaukseen L_2 putken 12 sisällä että tuoremassan M virtaukseen L_3 putken 13 sisällä. Putken 13 aaltopinnalla vaikutetaan sekundääripyörteitä tuottavasti siten sekä putkessa 12 virtautettuun palautuskierron vettä O että putkessa 13 virtautettuun massaan M.

Kuviossa 4A on esitetty pitkittäispoikkileikkaus keksinnön kolmannesta edullisesta suoritusmuodosta. Kuviossa 4B on esitetty leikkaus III - III kuviosta 4A.

Kuviossa 4A ja 4B on esitetty keksinnön suoritusmuoto, jossa aaltomaisuus on muodostettu virtausputkeen 12 niin, että aaltomaisuus vaikuttaa viiraveden V virtaukseen L_1 putkessa 11 että palautuskierron veden O virtaukseen L_2 putkessa 12.

Patenttivaatimukset

1. Laitteisto tuoremassan (M) ja viirakaivosta (10) johdetun viiraveden (V) sekoittamiseksi, **tunnettu** siitä, että viirakaivosta johdetun viiraveden (V) sekä putkesta (13) johdetun tuoremassan (M) sekoituskohdassa (K) on ainakin yksi sellainen putkiosuus, joka käsittää yhteydessään putken poikkileikkauksessa aaltomaisen muodon.

2. Patenttivaatimuksen 1 mukainen laitteisto, **tunnettu** siitä, että laitteisto käsittää putken (12) palautuskierron veden (O) tuomiseksi tuoremassan (M) ja viiraveden (V) sekoituskohtaan (K) ja että putki (13), jonka kautta massa (M) johdetaan, on johdettu koaksiaalisesti putken (12) sisällä.

3. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (11) käsittää seinäpinnallaan aaltomaisen muodon.

4. Edellisen patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putken (11) sisäpinnan aallotus on aikaansaatu muotokappaleiden (a_1, a_2, a_3...) avulla, jotka muotokappaleet ovat poikkileikkauksessa kaarevia ja jotka on asetettu välimatkan päähän toisistaan putken (11) kehämatkalle putken sisäpinnalle.

5. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (13), joka sijaitsee putken (12) sisällä, käsittää aaltomaisen pintamuodon, jolloin putkessa (12) virtautettu palautuskierron vesi (O) rajoittuu putken (13) aaltomaiseen ulkomuotoon, että putkessa (13) virtautettu massa (M) rajoittuu putken (13) aaltomaiseen sisämuotoon.

6. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (12), jonka kautta tuodaan palautuskierron vesi (O) putkeen (11), käsittää aallotuksen, joka muoto on sekä putken sisä- että ulkopinnalla, jolloin mainittuun aallotukseen rajoittuu sekä putkessa (11) virtaava viiravesi (V) että putkessa (12) virtautettu palautuskierron vesi (O).

7. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (12), että putki (13) on johdettu viiravesikaivon (10) alapuolisen kaarevan putkiosuuden (11) läpi niin, että putket (12 ja 13) on johdettu putken (11) seinämän läpi ja että putki (13) ulkonee putkesta (12) sen päädystä ja että putki (13) sijaitessa putken (12) sisällä keskeisesti.

8. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että kanava (11) käsittää pumpun (P) viiraveden, tuoremassan ja nollaveden sekoituskohdan (K) jälkeen niiden virtauttamiseksi paperikoneen/kartonkikoneen perälaatikolle (100).

9. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (11) kapenee virtaussuunnassa ($L_1 + L_2 + L_3$).

10. Menetelmä tuoremassan (M) ja viirakaivosta (10) johdetun viiraveden (V) sekoittamiseksi, **tunnettu** siitä, että viirakaivosta (10) johdetun viiraveden (V) sekä putkesta (13) johdetun tuoremassan (M) sekoituskohdassa (K) on ainakin yksi sellainen putkiosuus, jossa muodostetaan sekundääripyörteitä, jotka aikaansaadaan aaltomaisella putken pintamuodolla.

(57) Tiivistelmä

Keksinnön kohteena on laitteisto ja menetelmä tuoremassan (M) ja viirakaivosta (10) johdetun viiraveden (V) sekoittamiseksi. Viirakaivosta johdetun viiraveden (V) sekä putkesta (13) johdetun tuoremassan (M) sekoituskohdassa (K) on ainakin yksi sellainen putkiosuus, joka käsittää yhteydessään putken poikkileikkauksessa aaltomaisen muodon.

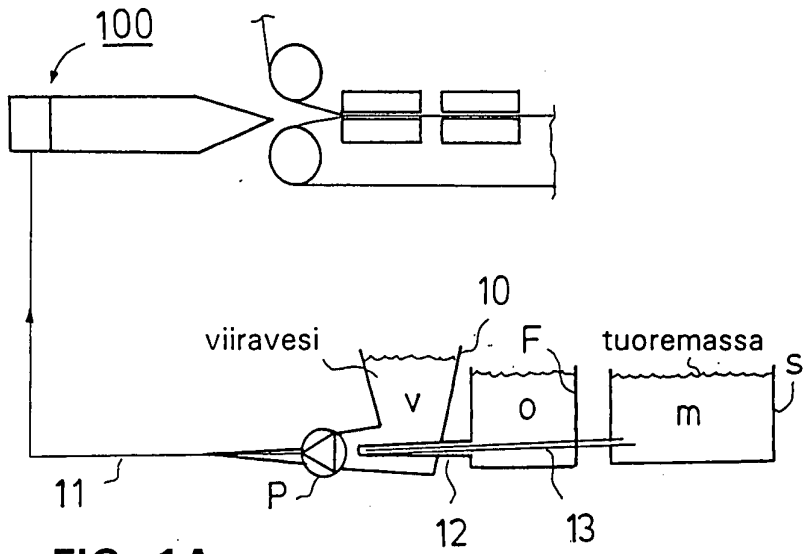
100
10
viiravesi
F
tuoremassa
S
v
o
m
11
P
12
13

FIG. 1A

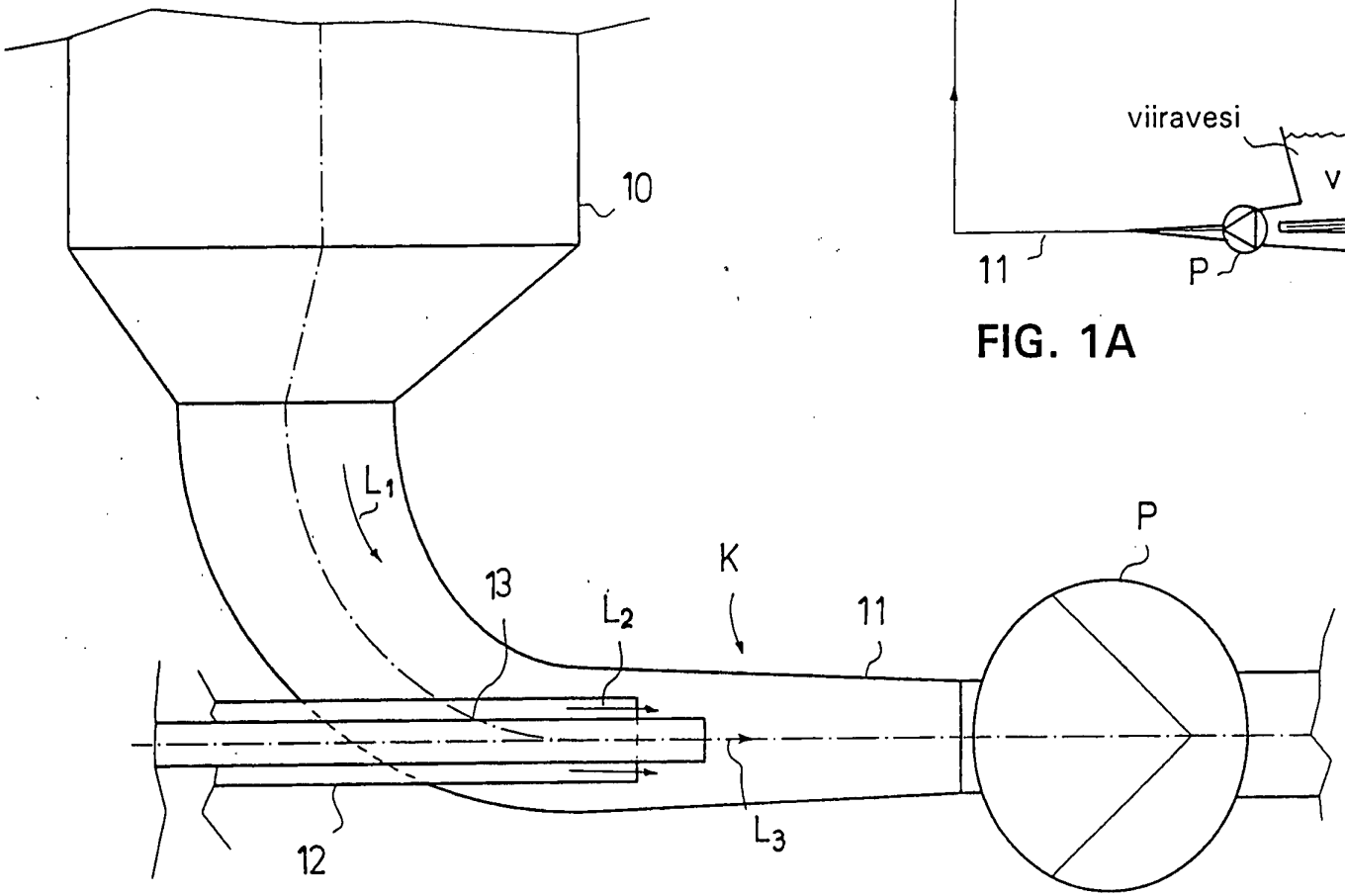
10
L1
13
L2
K
11
P
12
L3

FIG. 1B

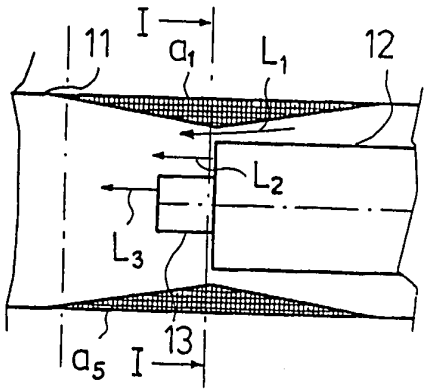

FIG. 2A

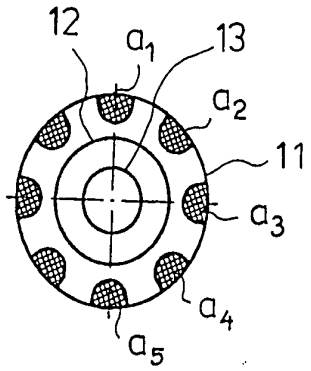

FIG. 2B

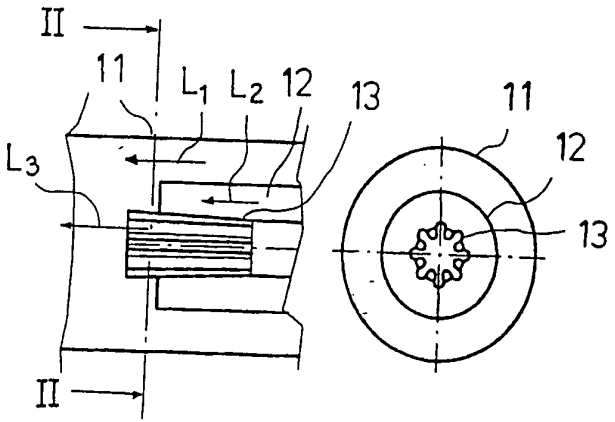

FIG. 3A

FIG. 3B

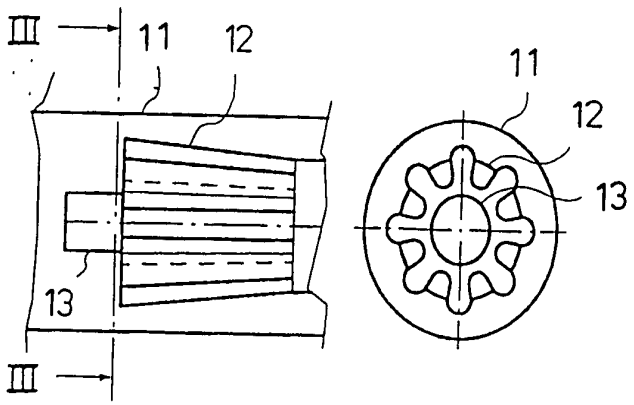

FIG. 4A

FIG. 4B

Laitteisto ja menetelmä paperi- tai kartonkikoneessa tuoremassan ja sen laimennukseen käytettävän veden sekoittamiseksi

Keksinnön kohteena on laitteisto ja menetelmä paperi- tai kartonkikoneessa paperin tai kartongin valmistukseen käytettävän tuoremassan ja sen laimennukseen käytettävän veden sekoittamiseksi.

Tekniikan tasosta tunnetaan laiteratkaisu, jossa paperikoneen tai kartonkikoneen viirakaivon jälkeiseen kapenevaan kanavaan johdetaan tuoremassa ja palautuskierto. Olennaista järjestelmässä on tuoremassan, viiraveden ja palautuskierron hyvä sekoittuminen.

Pyrittäessä paperikoneen/kartonkikoneen lyhyenkierron viiraveden ja tuoremassan hyvään sekoittumiseen ehdotetaan tässä hakemuksessa, että siinä kohdalla viirakaivon jälkeisessä kanavassa, johon tuoremassa tuodaan, käsittää ainakin yksi kanava pinnallaan virtauskanavan pitkittäisakseliin nähden kohtisuorassa poikkileikkauksessa aaltomaisen kanavamuodon. Kyseinen aaltomainen kanavamuoto aikaansaa virtaukseen sekundääripyörteitä, jotka johtavat virtausten tehokkaaseen sekoittumiseen.

Keksinnön mukaiselle laitteistolle on tunnusomaista, että laimennusveden sekä putkesta johdetun tuoremassan sekoituskohdassa on ainakin yksi sellainen putkiosuus, joka käsittää yhteydessään putken poikkileikkauksessa aaltomaisen muodon.

Keksinnön mukaiselle menetelmälle on tunnusomaista, että tuoremassan laimennukseen käytettävän veden sekä putkesta johdetun tuoremassan sekoituskohdassa muodostetaan sekundääripyörteitä, jotka aikaansaadaan aaltomaisella putken pintamuodolla.

Keksintöä selostetaan seuraavassa viittaamalla oheisien piirustuksien kuvioissa esitettyihin keksinnön eräisiin edullisiin suoritusmuotoihin, joihin keksintöä ei ole tarkoitus kuitenkaan yksinomaan rajoittaa.

Kuviossa 1A on esitetty keksinnön yleinen suoritusmuoto, jossa ylipäätänsä massan laimennukseen tarkoitettu vesi ja sakea massa sekoitetaan aallotettua putkimuotoa hyväksikäyttäen.

Kuviossa 1B on esitetty leikkaus IV—IV kuviosta 1A suurennetussa mittakaavassa.

Kuviossa 1C on esitetty periaatteellisesti paperikoneen/kartonkikoneen lyhyt kierto, jossa retentiona otettua viiravettä johdetaan viirakaivoon ja jonka viirakaivon pohjalta viiravettä johdetaan takaisinkiertona perälaatikkoon.

Kuviossa 1D on esitetty suurennetussa mittakaavassa keksinnön mukainen laitejärjestely, jossa viirakaivon pohjaosasta johdetun viiraveden yhteyteen johdetaan massan ja palautuskierron syöttöputket.

Kuviossa 2A on esitetty keksinnön ensimmäinen suoritusmuoto, jossa aaltomainen muoto on muodostettu viirakaivoon liittyvän putken 11 sisäseinämään.

Kuviossa 2B on esitetty leikkaus I—I kuviosta 2A.

Kuviossa 3A on esitetty keksinnön toinen suoritusmuoto, jossa aallotus on muodostettu putken 12 sisällä vietyyn putkeen 13.

Kuviossa 3B on esitetty leikkaus II—II kuviosta 3A.

Kuviossa 4A on esitetty keksinnön suoritusmuoto, jossa aaltomainen muoto on muodostettu putkeen 12.

Kuviossa 4B on esitetty leikkaus III—III kuviosta 4A.

Kuviossa 1A on esitetty keksinnön yleisin suoritusmuoto, jossa tuoremassan M laimennukseen käytettävä vesi V johdetaan putken 11 kautta ja sakea tuoremassa M putken 13 kautta. Putken 13 päätykohdassa ja sen jälkeen sakea massa M ja massan laimennukseen käytetty vesi V sekoittuvat keksinnön mukaisen putken 13 päädyn aallotuksen ansiosta. Kuviossa 1A esitetyssä suoritusmuodossa ulottuu aallotus sekä putken 13 sisälle että sen ulkopinnalle, jolloin tuoremassan M laimennukseen käytettävän veden V ja tuoremassan M sekoitus on tehokasta. Putkea 11 pitkin johdettu massan laimennukseen käytetty vesi on edullisesti viiravettä, joka johdetaan kuviossa 1A esitetysti säiliöstä 100. Säiliö 100 on kuviossa esitetysti paperikoneen tai kartonkikoneen lyhyenkierron ilmanpoistosäiliö, johon viiravesi V johdetaan erillisestä välisäiliöstä. Näin ollen keksinnön yleisimmässä suoritusmuodossa aallotetulla putkirakenteella 13 ylipäätänsä sekoitetaan sakea tuoremassa M ja sitä laimentava vesi V toisiinsa tehokkaasti ja laimennusvetenä on edullisesti paperikoneen/kartonkikoneen lyhyenkierron viiravesi.

Kuviossa 1B on esitetty leikkaus IV—IV kuviosta 1A. Kuviossa esitetysti käsittää sakean massan tuontilinja, edullisesti putki 13, päädyssään aallotuksen. Aallot ulottuvat sekä putken 13 sisäpuolelle että sen ulkopuolelle, jolloin ne vaikuttavat sekä putkessa 13 virtautettuun tuoremassaan M että sen ulkopuolella virtautettuun massanlaimennusveteen V edullisesti viiraveteen.

Kuviossa 1C on esitetty periaatteellisesti paperikoneen tai kartonkikoneen viiraveden lyhyenkierron viiravesikaivon käyttö retentiovesien keräämisessä sekä kuitupitoisen viiraveden uudelleen hyväksikäytössä, jolloin tuoremassa M ja palautuskierron vesi O johdetaan viiraveden V yhteyteen ja jossa rakenteessa edelleen yhdistynyt sekoittunut virtaus johdetaan viirakaivosta 10 paperikoneen tai kartonkikoneen perälaatikon 100 yhteyteen. Kuviossa 1C esitetysti viiralta johdetaan viiravedet viirakaivoon 10. Viirakaivon 10 pohjalla olevaan kanavaan 11 johdetaan paitsi viirakaivon 10 viiravettä V niin myös palautuskierron vesi O säiliöstä F että tuoremassa M massasäiliöstä S. Pumpun P avulla johdetaan yhdistynyt virtaus $L_1 + L_2 + L_3$ edelleen perälaatikolle 100.

Viirakaivon pohjalla sekoitetaan viiraveteen keksinnön mukaisesti tuoremassa ja palautuskierron vesi, joka on esim. perälaatikon ohikierto tai pyörrepuhdistuksen 2.vaiheen aksepti. Sakeusjärjestys on seuraava. Sakeinta on sakeamassa. Seuraavaksi sakeinta on palautuskierron vesi ja vähiten sakeinta on viiravesi (viivavesi < palautuskierto < sakeamassa).

Kuviossa 1D on esitetty keksinnön mukainen laitteisto, jossa nuolella L_1 esitetysti viiravesikaivosta 10 kuitupitoinen vesi johdetaan takaisin kiertoon putkeen 11. Putkeen 11 johdetaan myös tuoremassa M putkesta 13 sekä palautuskierron vesi O putkesta 12. Putki 12 on johdettu putken 11 sisälle kohdassa, jossa putki 11 kaareutuu ja virtauspoikkipinta-alaltaan kapenee. Putken 12 kautta johdetaan (nuoli L_2) palautuskierto eli palautuskierron vesi O viiraveden V yhteyteen. Putken 12 sisäpuolella keskeisesti sijaitsee putki 13. Putki 13 on johdettu koaksiaalisesti eli samaakselisesti putken 12 sisällä. Putken 13 kautta johdetaan (nuoli L_3) tuoremassa M palautuskierron veden O ja viiravesikaivosta 10 johdetun viiraveden V yhteyteen. Näin ollen putken 11 kapenevassa virtaustiessä kohdassa K sekoitetaan massa M, palautuskiertovesi O sekä viiravesi V. Pumppu P kuviossa esitetysti aikaansaa imun putkeen 11 ja pumpun P avulla johdetaan komponenttien V, M, O yhdistynyt virtaus $L_1 + L_2 + L_3$ eteenpäin paperikoneen/kartonkikoneen perälaatikon 100 yhteyteen.

Jotta massan M ja palautuskierron veden O sekä viiraveden V sekoittuminen olisi mahdollisimman tehokasta ja täydellistä, on virtausten L_1, L_2 ja L_3 sekoituskohdalta K ainakin jokin putkista 11, 12 tai 13 varustettu aaltomaisella pintamuodolla virtauskanavan pitkittäisakseliin nähden kohtisuorassa poikkileikkauksessa. Kyseinen aaltomainen pintamuoto aikaansaa ns. sekundääripyörteitä, jotka edesauttavat virtausten L_1, L_2 ja L_3 sekoittumista.

Kuviossa 2A on esitetty pitkittäispoikkileikkaus sekoituskohdasta K ja keksinnön ensimmäisestä edullisesta suoritusmuodosta. Kuviossa 2B on esitetty leikkaus I—I kuviosta 2A. Kuvioissa 2A ja 2B on esitetty suoritusmuoto, jossa putki 11 on varustettu ulkokehältään kiilamaisesti kapenevilla putken 11 sisäpinnan muotokappaleilla $a_1, a_2, a_3 \ldots$, jotka edelleen on siten muotoiltu, että poikkileikkauksessa

esitetysti aaltomaisuuden aikaansaavan kiilaosan a_1,a_2,a_3... maksimikorkeus kiilaosan a_1,a_2... keskellä on palautuskierron vettä O johtavan putken 12 päädyssä. Massaa M johtava putki 13 ulkonee edelleen putken 12 sisältä.

Kuviossa 3A on esitetty pitkittäispoikkileikkaus keksinnön toisesta suoritusmuodosta. Kuviossa 3B on esitetty leikkaus II—II kuviosta 3A.

Kuvioissa 3A ja 3B esitetyssä suoritusmuodossa aaltomaisuus on muodostettu putken 12 sisällä olevaan keskeiseen putkeen 13. Putki 13 ulkonee putkesta 12. Näin ollen toisiopyörteitä aikaansaadaan sekä palautuskierron veden O virtaukseen L_2 putken 12 sisällä että tuoremassan M virtaukseen L_3 putken 13 sisällä. Putken 13 aaltopinnalla vaikutetaan sekundääripyörteitä tuottavasti siten sekä putkessa 12 virtautettuun palautuskierron vettä O että putkessa 13 virtautettuun massaan M.

Kuviossa 4A on esitetty pitkittäispoikkileikkaus keksinnön kolmannesta edullisesta suoritusmuodosta. Kuviossa 4B on esitetty leikkaus III—III kuviosta 4A.

Kuviossa 4A ja 4B on esitetty keksinnön suoritusmuoto, jossa aaltomaisuus on muodostettu virtausputkeen 12 niin, että aaltomaisuus vaikuttaa viiraveden V virtaukseen L_1 putkessa 11 että palautuskierron veden O virtaukseen L_2 putkessa 12.

Patenttivaatimukset

1. Laitteisto paperi- tai kartonkikoneessa tuoremassan (M) ja tuotemassan laimennukseen käytetyn veden (V) sekoittamiseksi, **tunnettu** siitä, että laimennusveden (V) sekä putkesta (13) johdetun tuoremassan (M) sekoituskohdassa (K) on ainakin yksi sellainen putkiosuus, joka käsittää yhteydessään putken poikkileikkauksessa aaltomaisen muodon.

2. Patenttivaatimuksen 1 mukainen laitteisto, **tunnettu** siitä, että laimennusvetenä (V) on viiravesi.

3. Patenttivaatimuksen 1 tai 2 mukainen laitteisto, **tunnettu** siitä, että laitteisto käsittää putken (12) palautuskierron veden (O) tuomiseksi tuoremassan (M) ja viiraveden (V) sekoituskohtaan (K) ja että putki (13), jonka kautta massa (M) johdetaan, on johdettu koaksiaalisesti putken (12) sisällä.

4. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (11) käsittää seinäpinnallaan aaltomaisen muodon.

5. Edellisen patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putken (11) sisäpinnan aallotus on aikaansaatu muotokappaleiden (a_1,a_2,a_3...) avulla, jotka muotokappaleet ovat poikkileikkauksessa kaarevia ja jotka on asetettu välimatkan päähän toisistaan putken (11) kehämatkalle putken sisäpinnalle.

6. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (13), joka sijaitsee putken (12) sisällä, käsittää aaltomaisen pintamuodon, jolloin putkessa (12) virtautettu palautuskierron vesi (O) rajoittuu putken (13) aaltomaiseen ulkomuotoon, että putkessa (13) virtautettu massa (M) rajoittuu putken (13) aaltomaiseen sisämuotoon.

7. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (12), jonka kautta tuodaan palautuskierron vesi (O) putkeen (11), käsittää

aallotuksen, joka muoto on sekä putken sisä- että ulkopinnalla, jolloin mainittuun aallotukseen rajoittuu sekä putkessa (11) virtaava viiravesi (V) että putkessa (12) virtautettu palautuskierron vesi (O).

8. Edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (12), että putki (13) on johdettu viiravesikaivon (10) alapuolisen kaarevan putkiosuuden (11) läpi niin, että putket (12 ja 13) on johdettu putken (11) seinämän läpi ja että putki (13) ulkonee putkesta (12) sen päädystä ja että putki (13) sijaitessa putken (12) sisällä keskeisesti.

9. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että kanava (11) käsittää pumpun (P) viiraveden, tuoremassan ja nollaveden sekoituskohdan (K) jälkeen niiden virtauttamiseksi paperikoneen/kartonkikoneen perälaatikolle (100).

10. Jonkin edellä olevan patenttivaatimuksen mukainen laitteisto, **tunnettu** siitä, että putki (11) kapenee virtauksen ($L_1 + L_2 + L_3$) virtaussuunnassa.

11. Patenttivaatimuksen 2 mukainen laitteisto, **tunnettu** siitä, että laimennusvetenä käytettävä viiravesi (V) johdetaan paperikoneen/kartonkikoneen lyhyenkierron ilmanpoistosäiliöstä (100).

12. Menetelmä paperi- tai kartonkikoneessa tuoremassan (M) ja sen laimennukseen käytettävän veden (V) sekoittamiseksi, **tunnettu** siitä, että tuoremassan (M) laimennukseen käytettävän veden (V) sekä putkesta (13) johdetun tuoremassan (M) sekoituskohdassa (K) muodostetaan sekundääripyörteitä, jotka aikaansaadaan aaltomaisella putken (11 ja/tai 12 ja/tai 13) pintamuodolla.

13. Patenttivaatimuksen 12 mukainen menetelmä, **tunnettu** siitä, että laimennusvetenä (V) käytetään viiravettä.

14. Edellä olevan patenttivaatimuksen mukainen menetelmä, **tunnettu** siitä, että viiravesi johdetaan paperikoneen/kartonkikoneen viiraveden lyhyenkierron ilmanpoistosäiliöstä (100).

5

Tiivistelmä

Keksinnön kohteena on laitteisto ja menetelmä paperi- tai kartonkikoneessa tuoremassan (M) ja sen laimennukseen käytettävän veden (V) sekoittamiseksi. Laimennusveden (V) sekä putkesta (13) johdetun tuoremassan (M) sekoituskohdassa (K) on ainakin yksi sellainen putkiosuus, joka käsittää yhteydessään putken poikkileikkauksessa aaltomaisen muodon.

(FIG. 1A ja 1B)

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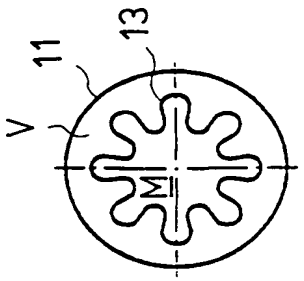

FIG. 1B

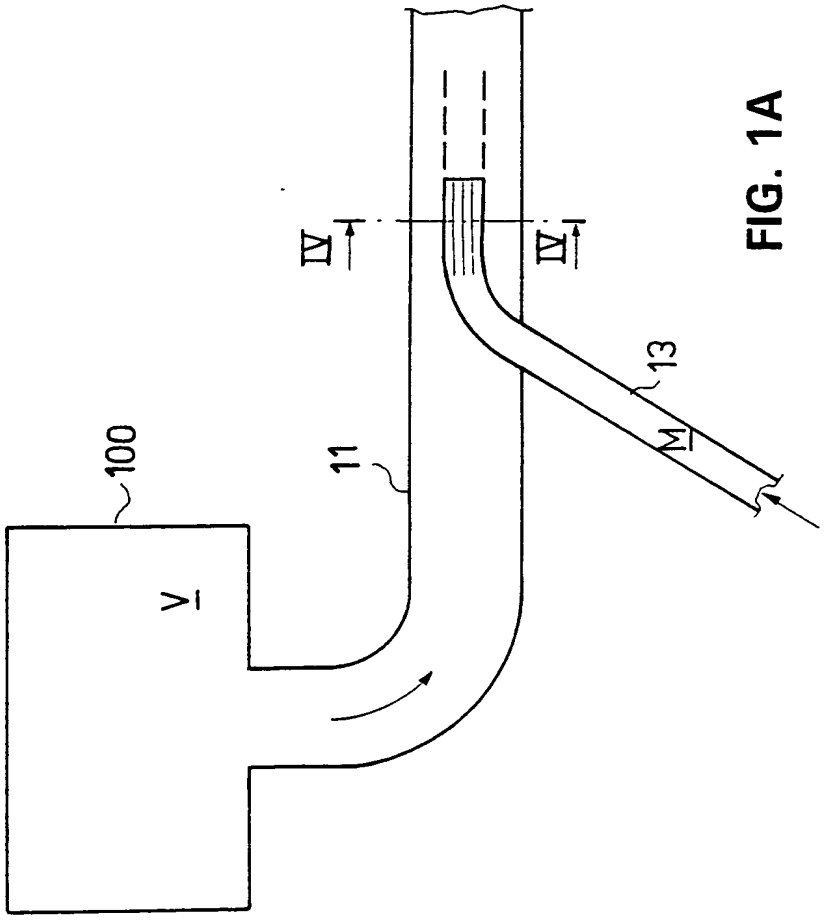

FIG. 1A

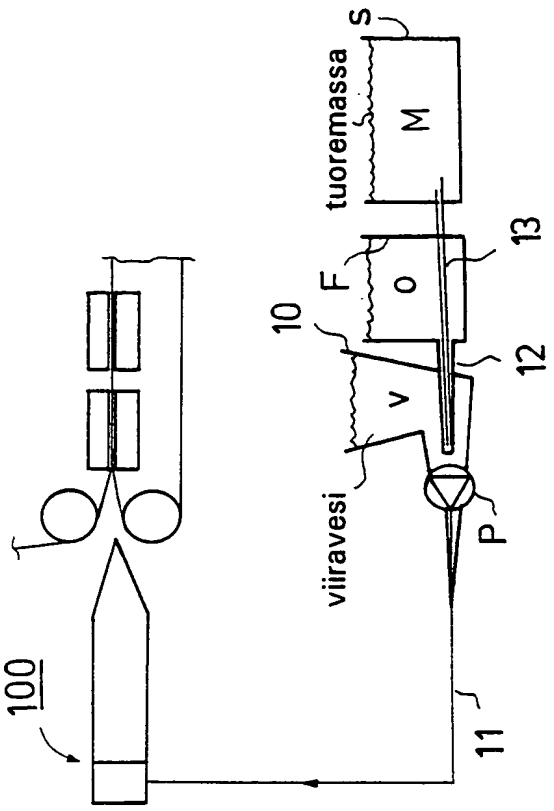
S
tuoremassa
M
13
F
O
10
12
V
viiravesi
P
100
11

FIG. 1C

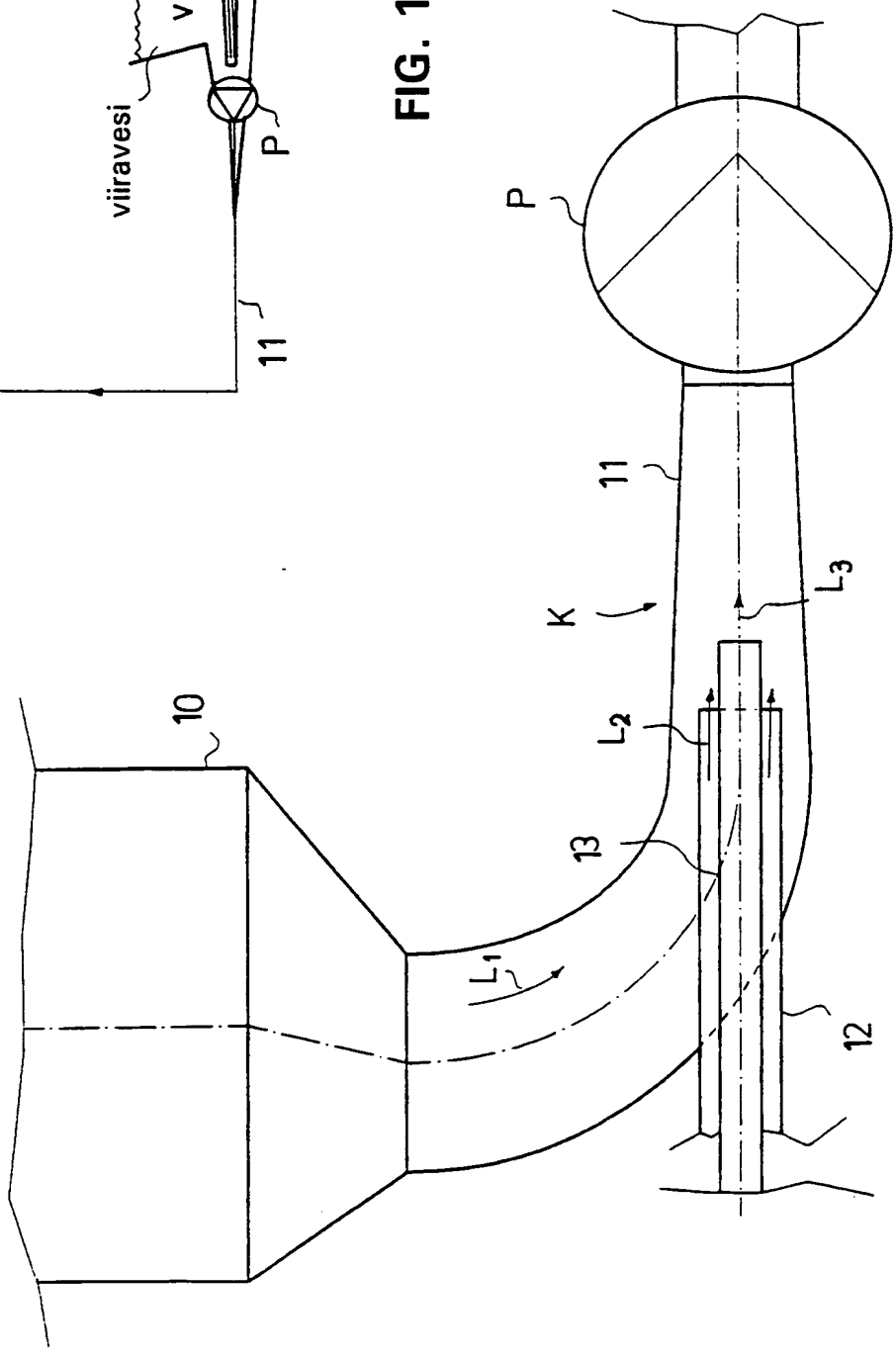
P
11
K
L_3
L_2
10
13
L_1
12

FIG. 1D

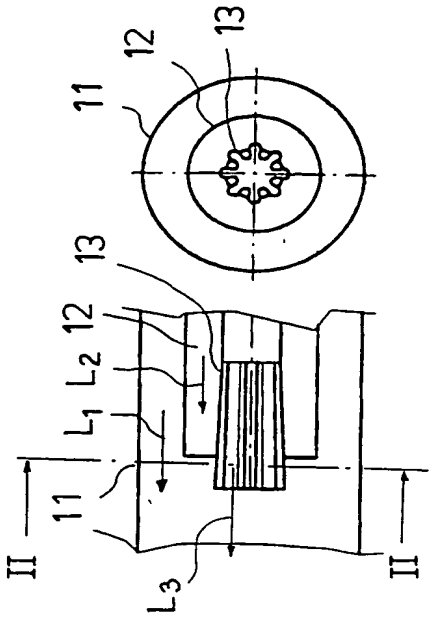

FIG. 3A

FIG. 3B

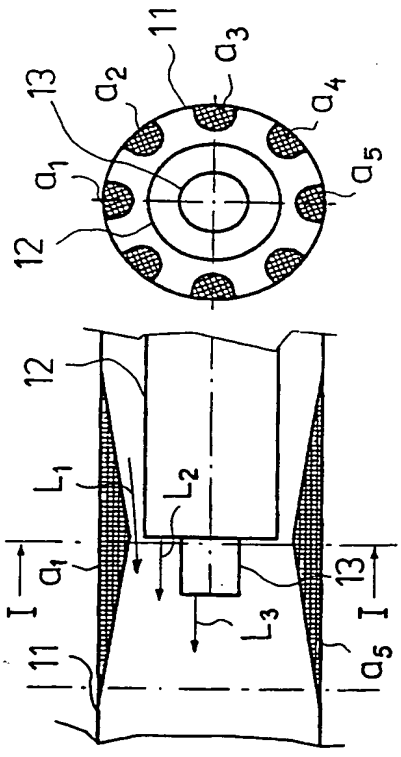

FIG. 2B

FIG. 2A

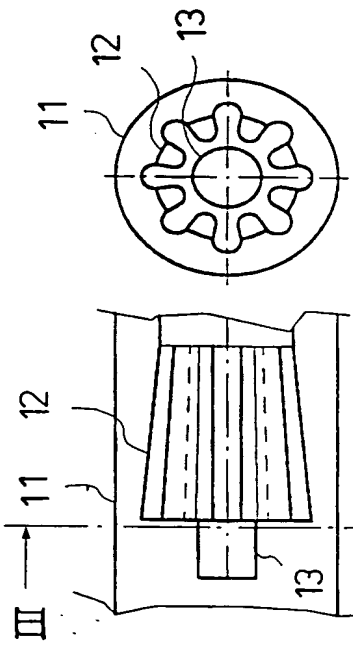

FIG. 4B

FIG. 4A

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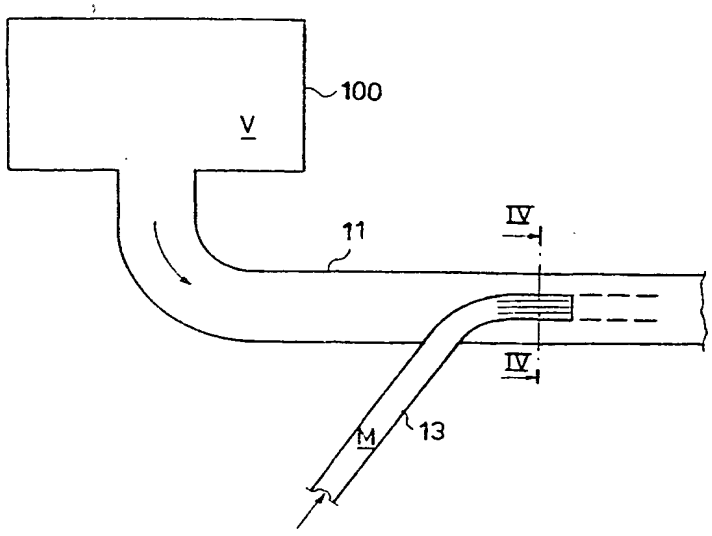

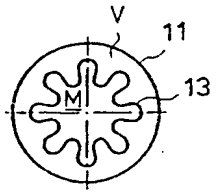

(57) Abstract

The invention concerns an equipment and a method in a paper or board machine for mixing fresh stock (M) with water (V) used for dilution of the fresh stock. At the point of mixing (K) of the dilution water (V) and the fresh stock (M) passed from the pipe (13), there is at least one such pipe portion as comprises a wave-shaped form in its connection in the cross section of the pipe.

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Equipment and method in a paper or board machine for mixing of fresh stock and of water for dilution of fresh stock

The invention concerns an equipment and a method in a paper or board machine for mixing fresh stock used for manufacture of paper or board with water used for dilution of the fresh stock.

From the prior art, a solution of equipment is known in which fresh stock and a return circulation are passed into a narrowing duct after the wire pit in a paper or board machine. An essential feature of the system is good mixing of fresh stock, white water, and the return circulation.

In an attempt to obtain good mixing of the white water of the short circulation and of fresh stock in a paper/board machine, in the present patent application it is suggested that, in the area in the duct after the wire pit in which the fresh stock is introduced, at least one duct comprises, on its face, a duct form that is wave-shaped in a cross-section perpendicular to the longitudinal axis of the flow duct. Said wave-shaped duct form produces secondary vortexes in the flow, which vortexes result in efficient mixing of the flows.

The equipment in accordance with the present invention is characterized in that, at the point of mixing of the dilution water and the fresh stock passed from the pipe, there is at least one such pipe portion as comprises a wave-shaped form in its connection in the cross-section of the pipe.

The method in accordance with the invention is characterized in that, at the point of mixing of the water used for dilution of fresh stock and the fresh stock passed from the pipe, secondary vortexes are formed, which are formed by means of a wave-shaped face form of the pipe.

The invention will be described in the following with reference to some preferred embodiments of the invention illustrated in the figures in the accompanying drawings, the invention being, yet, not supposed to be confined to said embodiments alone.

Figure 1A illustrates a common embodiment of the invention, in which a water in general, which has been meant for dilution of stock, and a high-consistency stock are mixed while making use of a wave-shaped pipe form.

Figure 1B is a sectional view taken along the line IV - IV in Fig. 1A on an enlarged scale.

Figure 1C is an illustration of principle of the short circulation in a paper/board machine, in which white water that has been recovered as retention is passed into the wire pit, white water being passed from the bottom of the wire pit as a return circulation into the headbox.

Figure 1D is an illustration on a larger scale of an arrangement of equipment in accordance with the invention in which feed pipes of stock and of the return circulation are passed into connection with the white water passed from the bottom portion of the wire pit.

Figure 2A shows a first embodiment of the invention, in which the wave-shaped form has been formed onto the inner wall of the pipe 11 connected with the wire pit.

Figure 2B is a sectional view taken along the line I—I in Fig. 2A.

Figure 3A shows a second embodiment of the invention, in which the wave shape has been formed onto a pipe 13 passed in the interior of the pipe 12.

Figure 3B is a sectional view taken along the line II—II in Fig. 3A.

Figure 4A shows an embodiment of the invention, in which the wave-shaped form has been formed onto the pipe 12.

Figure 4B is a sectional view taken along the line III—III in Fig. 4A.

Fig. 1A illustrates the commonest embodiment of the invention, in which the water V used for dilution of fresh stock M is passed through the pipe 11, and the high-consistency fresh stock M is passed through the pipe 13. At the end of the pipe 13 and after said end, the high-consistency stock M and the water V used for dilution of the stock are mixed with each other owing to the wave formation in accordance with the invention at the end of the pipe 13. In the embodiment shown in Fig. 1A, the wave form extends both to the interior of the pipe 13 and to the outer face of the pipe, in which case the mixing of the water V used for dilution of the fresh stock M with the fresh stock M is efficient. The water passed along the pipe 11 and used for dilution of the stock is favourably white water, which is passed, in the way shown in Fig. 1A, from the tank 100. As is shown in the figure, the tank 100 is a deaeration tank of the short circulation in a paper or board machine, into which tank the white water V is passed from a separate intermediate tank. Thus, in the commonest embodiment of the invention, by means of the wave-shaped pipe construction 13, in general, the high-consistency fresh stock M and the water V that dilutes said stock are mixed with each other efficiently, and the dilution water favourably consists of the white water of the short circulation in the paper/board machine.

Fig. 1B is a sectional view taken along the line IV—IV in Fig. 1A. As is shown in the figure, the line of supply of the high-consistency stock, preferably a pipe 13, is provided with a wave formation at its end. The waves extend both inside and outside the pipe 13, in which case they act both upon the fresh stock M flowing in the pipe 13 and upon the stock dilution water V, favourably white water, flowing outside the pipe 13.

Fig. 1C is an illustration of principle of the use of the white-water pit of the short circulation in a paper or board machine in collecting of retention waters and in

recycling of fibrous white water, in which connection the fresh stock M and the water O of the return circulation are passed into connection with the white water V and in which construction, further, the combined mixed flow is passed from the wire pit 10 into connection with the headbox 100 of the paper or board machine. As is shown in Fig. 1C, the white waters are passed from the wire into the wire pit 10. Into the duct 11 placed at the bottom of the wire pit 10, besides white water V from the wire pit 10, the water O of the return circulation from the tank F and the fresh stock M from the stock tank S are also passed. By means of a pump P, the combined flow $L_1 + L_2 + L_3$ is passed further into the headbox 100.

At the bottom of the wire pit, in accordance with the invention, the white water is mixed with the fresh stock and with the water of the return circulation, which water is, for example, a bypass flow circulation from the headbox or an accept from the second stage of vortex cleaning. The sequence of consistencies is as follows. The highest consistency is that of the high-consistency stock. The next consistency is that of the water from the return circulation, and the lowest consistency is that of the white water (white water < return circulation < high-consistency stock).

Fig. 1D shows an equipment in accordance with the invention, in which, in the way indicated by the arrow L_1, the fibrous water is passed from the white-water pit 10 back to circulation into the pipe 11. Into the pipe 11, also fresh stock M is passed from the pipe 13, and the water O of the return circulation is passed from the pipe 12. The pipe 12 has been passed into the interior of the pipe 11 in an area in which the pipe 11 is curved and its cross-sectional flow area becomes narrower. Through the pipe 12, the return circulation, i.e. the water O of the return circulation, is passed (arrow L_2) into connection with the white water V. Centrally in the interior of the pipe 12, there is the pipe 13. The pipe 13 has been passed coaxially in the interior of the pipe 12. Through the pipe 13 (arrow L_3) the fresh stock M is passed into connection with the water O of the return circulation and with the white water V passed from the wire pit 10. Thus, in the narrowing flow passage in the pipe 11, in the area K, the stock M, the return circulation water O, and the white water V are mixed. As is shown in the figure, the pump P produces suction in the pipe 11, and

by means of the pump P the combined flow $L_1 + L_2 + L_3$ of the components V, M, O is passed further into connection with the headbox 100 of the paper/board machine.

In order that the mixing of the stock M and of the return circulation water O and of the white water V should be as efficient and complete as possible, in the area K of mixing of the flows L_1, L_2 and L_3, at least one of the pipes 11, 12 or 13 is provided with a wave-shaped face form in a cross-section perpendicular to the longitudinal axis of the flow duct. Said wave-shaped face form produces what is called secondary vortexes, which promote the mixing together of the flows L_1, L_2 and L_3.

Fig. 2A is a longitudinal sectional view of the mixing area K and of a first preferred embodiment of the invention. Fig. 2B is a sectional view taken along the line I - I in Fig. 2A. Figs. 2A and 2B show an embodiment in which the pipe 11 has been provided with form pieces $a_1,a_2,a_3\ldots$, whose outer circumference becomes narrower in wedge shape, which have been fitted on the inner face of the pipe 11, and which have been further shaped so that, as shown in the cross-sectional view, the maximal height of the wedge part $a_1,a_2,a_3\ldots$ that produces the wave shape, in the middle of the wedge part a_1, $a_2\ldots$, is placed in the area of the end of the pipe 12 that passes the water O of the return circulation. The pipe 13 that passes the stock M projects further from the interior of the pipe 12.

Fig. 3A is a longitudinal sectional view of a second embodiment of the invention. Fig. 3B is a sectional view taken along the line II—II in Fig. 3A.

In the embodiment shown in Figs. 3A and 3B, the wave shape has been formed onto the central pipe 13 fitted inside the pipe 12. The pipe 13 projects from the pipe 12. Thus, secondary vortexes are produced both in the flow L_2 of the return circulation water O inside the pipe 12 and in the flow L_3 of fresh stock M inside the pipe 13. Thus, by means of the wave-shaped face of the pipe 13, an effect that produces secondary vortexes is applied both to the return circulation water O flowing in the pipe 12 and to the stock M that flows in the pipe 13.

Fig. 4A is a longitudinal sectional view of a third preferred embodiment of the invention. Fig. 4B is a sectional view taken along the line III—III in Fig. 4A.

Figs. 4A and 4B show an embodiment of the invention in which the wave shape has been formed onto the flow pipe 12 so that the wave shape acts upon the flow L_1 of white water V in the pipe 11 and upon the flow L_2 of the return circulation water O in the pipe 12.

Claims

1. An equipment in a paper or board machine for mixing fresh stock (M) with water (V) used for dilution of the fresh stock, **characterized** in that, at the point of mixing (K) of the dilution water (V) and the fresh stock (M) passed from the pipe (13), there is at least one such pipe portion as comprises a wave-shaped form in its connection in the cross-section of the pipe.

2. An equipment as claimed in claim 1, **characterized** in that the dilution water (V) consists of white water.

3. An equipment as claimed in claim 1 or 2, **characterized** in that the equipment comprises a pipe (12) for passing the return circulation water (O) to the mixing point (K) of fresh stock (M) and white water (V), and that the pipe (13), through which the stock (M) is passed, has been passed coaxially in the interior of the pipe (12).

4. An equipment as claimed in any of the preceding claims, **characterized** in that the pipe (11) is provided with a wave-shaped form on its wall face.

5. An equipment as claimed in the preceding claim, **characterized** in that the wave shape on the inner face of the pipe (11) has been produced by means of form pieces (a_1,a_2,a_3...), which form pieces are of curved cross-section and which have been fitted at a distance from one another on the circumferential measure of the pipe (11) on the inner face of the pipe (11).

6. An equipment as claimed in any of the preceding claims, **characterized** in that the pipe (13), which is placed in the interior of the pipe (12), is provided with a wave-shaped face form, in which case the return circulation water (O) that is passed in the pipe (12) is confined by the wave-shaped outer shape of the pipe (13), and the stock (M) that is passed in the pipe (13) is confined by the wave-shaped inner shape of the pipe (13).

7. An equipment as claimed in any of the preceding claims, **characterized** in that the pipe (12), through which the return circulation water (O) is introduced in the pipe (11), is provided with a wave shape, whose form is provided both on the inner face and on the outer face of the pipe, in which connection both the white water (V) flowing in the pipe (11) and the return circulation water (O) passed in the pipe (12) are confined by said wave shape.

8. An equipment as claimed in the preceding claim, **characterized** in that the pipe (12) and the pipe (13) have been passed through the curved pipe portion (11) placed below the white-water pit (10) so that the pipes (12 and 13) have been passed through the wall of the pipe (11), and that the pipe (13) projects from the end of the pipe (12), and that the pipe (13) is placed centrally inside the pipe (12).

9. An equipment as claimed in any of the preceding claims, **characterized** in that the duct (11) comprises a pump (P) placed after the mixing point (K) of white water, fresh stock, and circulation water in view of passing said materials into the headbox (100) of the paper/board machine.

10. An equipment as claimed in any of the preceding claims, **characterized** in that the pipe (11) becomes narrower in the flow direction of the flow ($L_1 + L_2 + L_3$).

11. An equipment as claimed in claim 2, **characterized** in that the white water (V) that is used as the dilution water is passed from the deaeration tank (100) of the short circulation in the paper/board machine.

12. A method in a paper or board machine for mixing fresh stock (M) with water (V) used for dilution of the fresh stock, **characterized** in that, at the point of mixing (K) of the water (V) used for dilution of fresh stock (M) and the fresh stock (M) passed from the pipe (13), secondary vortexes are formed, which are formed by means of a wave-shaped face form of the pipe (11 and/or 12 and/or 13).

13. A method as claimed in claim 12, **characterized** in that white water is used as the dilution water (V).

14. A method as claimed in the preceding claim, **characterized** in that the white water is passed from the deaeration tank (100) of the short circulation of the white water in the paper/board machine.

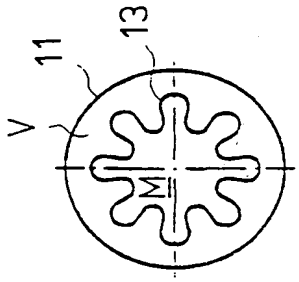

FIG. 1B

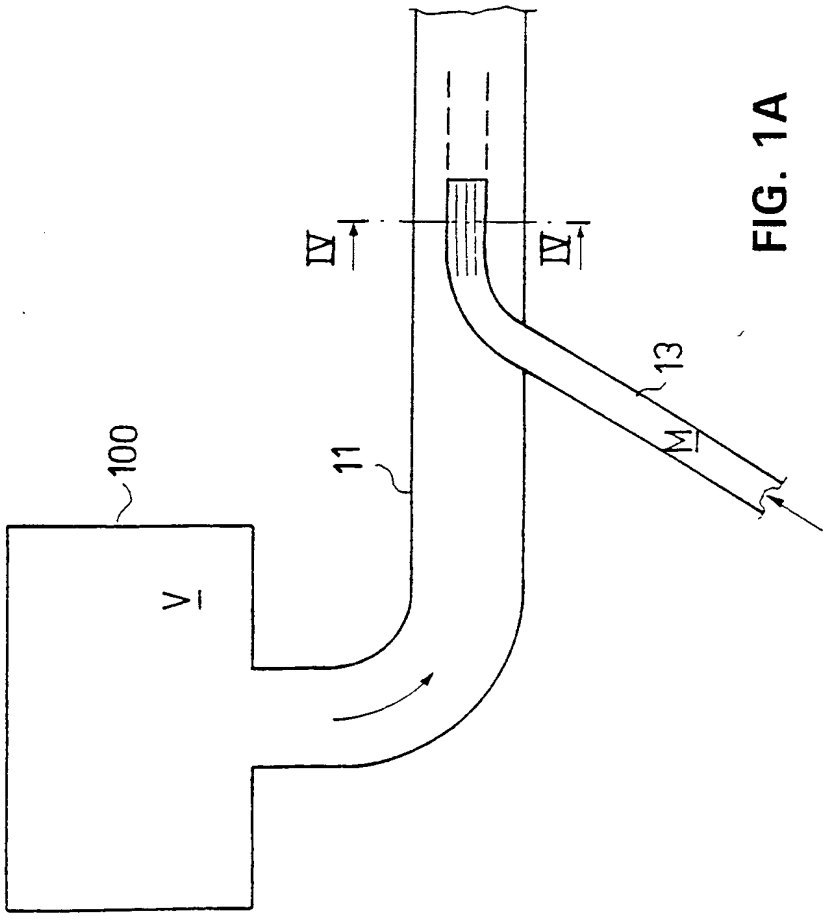

FIG. 1A

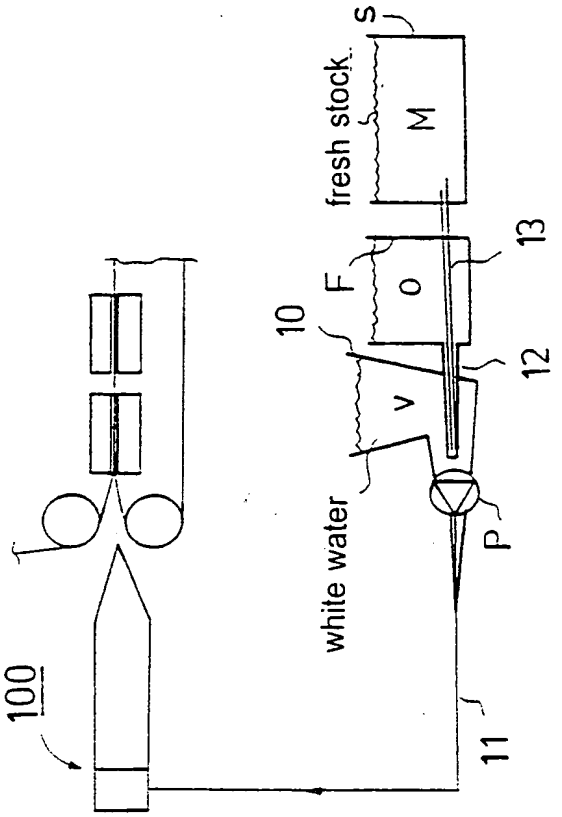
S
fresh stock
M
13
F
O
10
12
V
white water
P
100
11

FIG. 1C

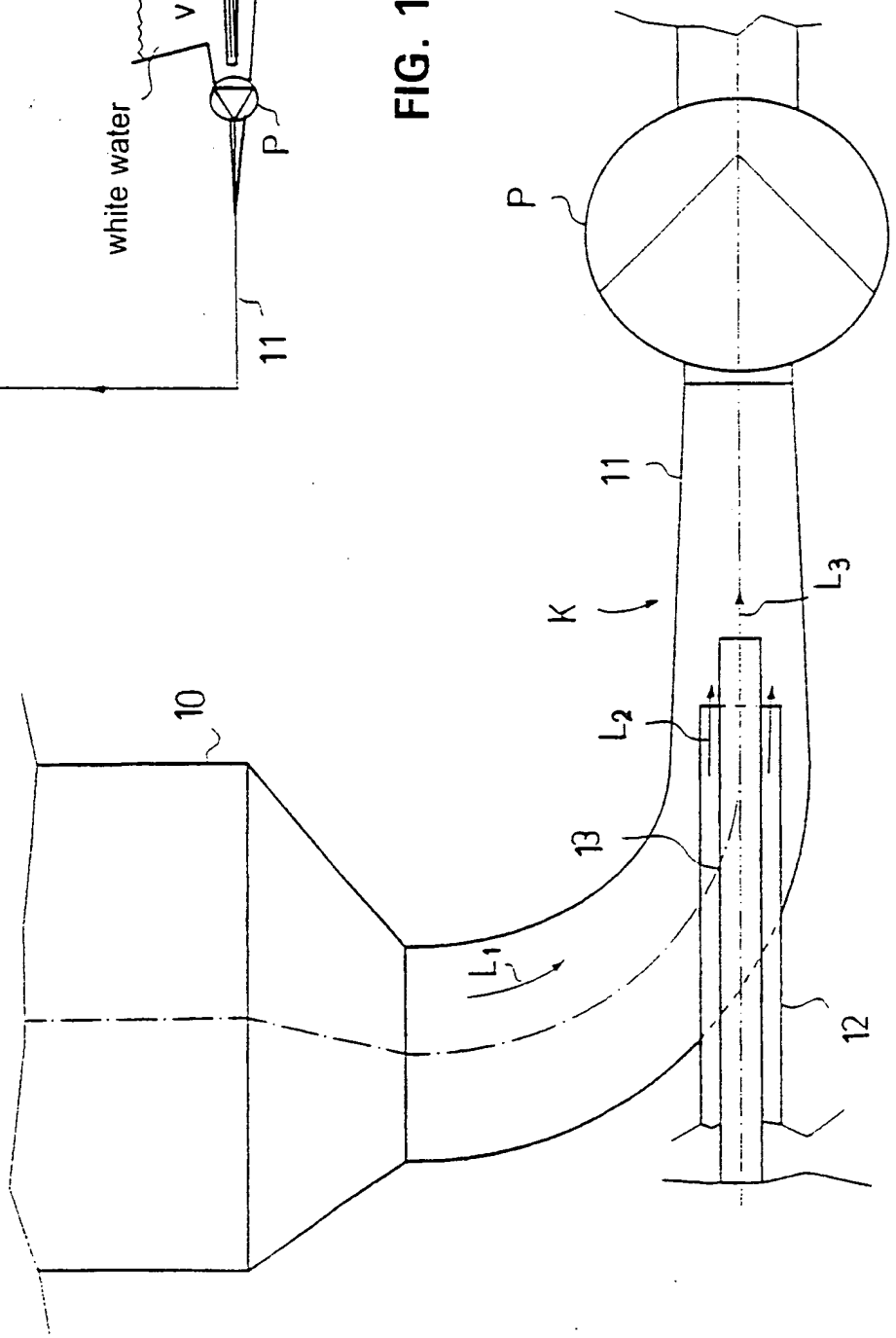
P
11
K
L_3
L_2
10
13
L_1
12

FIG. 1D

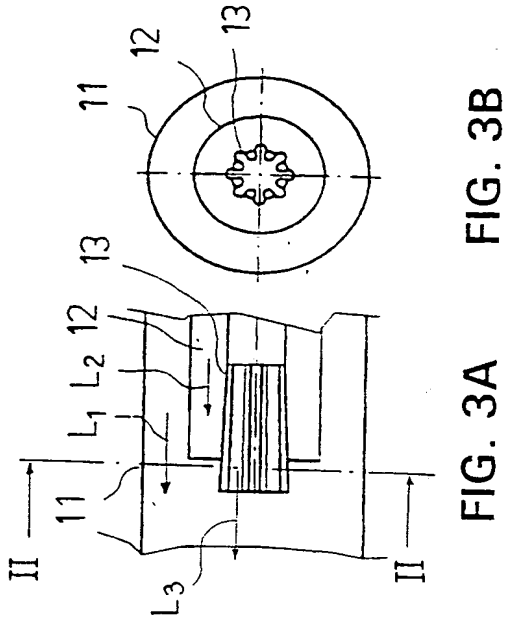

FIG. 3A

FIG. 3B

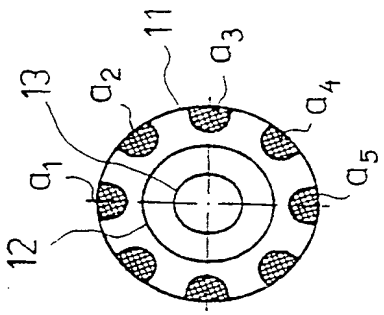

FIG. 2B

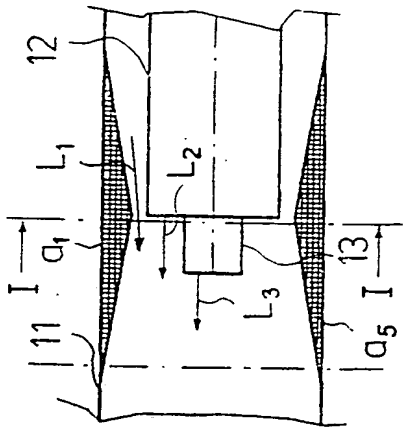

FIG. 2A

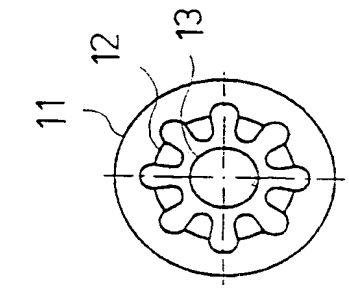

FIG. 4B

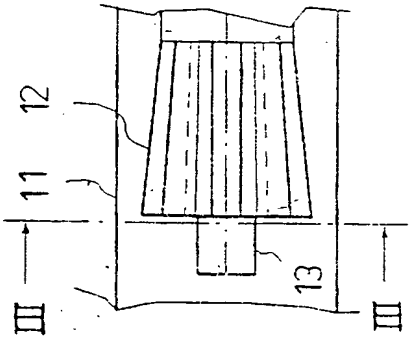

FIG. 4A

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00458

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21F 1/08
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG: ALLSCIENCE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5030326 A (JEAN P. NOUS), 9 July 1991 (09.07.91), figure 2 --	1,12
A	US 3839145 A (KARL EUGEN BUECKLE), 1 October 1974 (01.10.74), figures 1,2 -- --------	1,12

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 October 1999	08 -10- 1999
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Olov Jensén/ELY Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/08/99

International application No.
PCT/FI 99/00458

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5030326 A	09/07/91	CA 1327471 A	08/03/94
		EP 0418445 A	27/03/91
		FR 2631353 A	17/11/89
US 3839145 A	01/10/74	DE 2045920 A,B,C	23/03/72
		FR 2107699 A	05/05/72
		SE 370556 B,C	21/10/74

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PATENT COOPERATION TREATY

PCT

REC'D 28 SEP 2000
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference MH/FI981286	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI99/00458	International filing date *(day/month/year)* 27.05.1999	Priority date *(day/month/year)* 05.06.1998
International Patent Classification (IPC) or national classification and IPC7 D 21 F 1/08		
Applicant Valmet Corporation et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of _____ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
26.10.1999	19.09.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Ulrika Nilsson/ELY Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00458

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☒ the international application as originally filed.

☐ the description, pages _____ , as originally filed,
pages _____ , filed with the demand,
pages _____ , filed with the letter of _____ ,
pages _____ , filed with the letter of _____ .

☐ the claims, Nos. _____ , as originally filed,
Nos. _____ , as amended under Article 19,
Nos. _____ , filed with the demand,
Nos. _____ , filed with the letter of _____ ,
Nos. _____ , filed with the letter of _____ .

☐ the drawings, ~~sheets~~/fig _____ , as originally filed,
~~sheets~~/fig _____ , filed with the demand
~~sheets~~/fig _____ , filed with the letter of _____ ,
~~sheets~~/fig _____ , filed with the letter of _____ .

2. The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, ~~sheets~~/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/FI99/00458

V. Resoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-14	YES
	Claims		NO
Inventive step (IS)	Claims	1-14	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-14	YES
	Claims		NO

2. Citations and explanations

The claimed invention concerns an equipment and a method in a paper or board machine for mixing fresh stock and water for dilution of the fresh stock.

The aim of the invention is to enable a good mixing of white water of the short circulation and of fresh stock.

For this purpose, in the area in the duct after the wire pit in which the fresh stock is introduced, at least one duct comprises a duct form that is wave-shaped in a cross-section perpendicular to the longitudinal axis of the flow duct. The wave-shaped duct forms secondary vortexes, which promote the mixing of the different flows.

The following documents are cited in the International Search Report:

D1: US 5 030 326 A
D2: US 3 839 145 A

D1 relates to a feed device for paper pulp, designed to form a flat like film of paste through at least one nozzle at the outlet from a distribution chamber. The feed device has separate valved lines for liquid and pulp concentrate. The system allows i.e. flow rate and density of the individual flows to be controlled independently.

D2 represents less relevant prior art concerning an apparatus and a method for forming a fibre suspension and for delivering it to the wire of a machine for manufacturing non-woven materials.

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

None of the documents D1-D2 disclose the special combination of features defined in the invention. Neither is it considered obvious to a person skilled in the art to modify the known technique in D1 or D2 so as to obtain the equipment or the method such as claimed in the invention.

In view of the arguments stated above, the claimed invention according to claims 1-14 is novel, is considered to involve an inventive step and has industrial applicability.

RECORD COPY

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No. PCT/FI99/00458

International Filing Date 27 MAY 1999 (27.05.99)

The Finnish Patent Office
PCT International Application
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* MH/FI981286

Box No. I TITLE OF INVENTION

Equipment and method in a paper or board machine for mixing of fresh stock and of water for dilution of fresh stock

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

VALMET CORPORATION
Panuntie 6
FIN-00620 HELSINKI
Finland

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: Finland

State *(that is, country)* of residence: Finland

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

RAHKOMAA Jouni
Ketokuja 3
FIN-33730 TAMPERE
Finland

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is,country)* of nationality: Finland

State *(that is, country)* of residence: Finland

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Forssén & Salomaa Oy
Yrjönkatu 30
FIN-00100 Helsinki
Finland

Telephone No. +358 9 615 3500

Facsimile No. +358 9 615 35111

Teleprinter No.

☐ **Adress for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

SOINI Sakari
Kermisenkuja 5 C 16
FIN-31400 SOMERO
Finland

This person is:
- [ ] applicant only
- [X] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: Finland

State *(that is, country)* of residence: Finland

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [X] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- [ ] applicant only
- [ ] applicant and inventor
- [ ] inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- [ ] all designated States
- [ ] all designated States except the United States of America
- [ ] the United States of America only
- [ ] the States indicated in the Supplemental Box

- [ ] Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☒ **AP** **ARIPO Patent:** **GH** Ghana, **GM** Gambia, **KE** Kenya, **LS** Lesotho, **MW** Malawi, **SD** Sudan, **SZ** Swaziland, **UG** Uganda, **ZW** Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA** **Eurasian Patent:** **AM** Armenia, **AZ** Azerbaijan, **BY** Belarus, **KG** Kyrgyzstan, **KZ** Kazakhstan, **MD** Republic of Moldova, **RU** Russian Federation, **TJ** Tajikistan, **TM** Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** **European Patent:** **AT** Austria, **BE** Belgium, **CH and LI** Switzerland and Liechtenstein, **CY** Cyprus, **DE** Germany, **DK** Denmark, **ES** Spain, **FI** Finland, **FR** France, **GB** United Kingdom, **GR** Greece, **IE** Ireland, **IT** Italy, **LU** Luxembourg, **MC** Monaco, **NL** Netherlands, **PT** Portugal, **SE** Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA** **OAPI Patent:** **BF** Burkina Faso, **BJ** Benin, **CF** Central African Republic, **CG** Congo, **CI** Côte d'Ivoire, **CM** Cameroon, **GA** Gabon, **GN** Guinea, **GW** Guinea-Bissau, **ML** Mali, **MR** Mauritania, **NE** Niger, **SN** Senegal, **TD** Chad, **TG** Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ☒ **AL** Albania
- ☒ **AM** Armenia
- ☒ **AT** Austria and Utility Model
- ☒ **AU** Australia
- ☒ **AZ** Azerbaijan
- ☒ **BA** Bosnia and Herzegovina
- ☒ **BB** Barbados
- ☒ **BG** Bulgaria
- ☒ **BR** Brazil
- ☒ **BY** Belarus
- ☒ **CA** Canada
- ☒ **CH and LI** Switzerland and Liechtenstein
- ☒ **CN** China
- ☒ **CU** Cuba
- ☒ **CZ** Czech Republic and Utility Model
- ☒ **DE** Germany and Utility Model
- ☒ **DK** Denmark and utility Model
- ☒ **EE** Estonia and Utility Model
- ☒ **ES** Spain
- ☒ **FI** Finland and Utility Model
- ☒ **GB** United Kingdom
- ☒ **GD** Grenada
- ☒ **GE** Georgia
- ☒ **GH** Ghana
- ☒ **GM** Gambia
- ☒ **HR** Croatia
- ☒ **HU** Hungary
- ☒ **ID** Indonesia
- ☒ **IL** Israel
- ☒ **IN** India
- ☒ **IS** Iceland
- ☒ **JP** Japan
- ☒ **KE** Kenya
- ☒ **KG** Kyrgyzstan
- ☒ **KP** Democratic People's Republic of Korea
- ☒ **KR** Republic of Korea
- ☒ **KZ** Kazakhstan
- ☒ **LC** Saint Lucia
- ☒ **LK** Sri Lanka
- ☒ **LR** Liberia
- ☒ **LS** Lesotho
- ☒ **LT** Lithuania
- ☒ **LU** Luxembourg
- ☒ **LV** Latvia
- ☒ **MD** Republic of Moldova
- ☒ **MG** Madagascar
- ☒ **MK** The former Yugoslav Republic of Macedonia
- ☒ **MN** Mongolia
- ☒ **MW** Malawi
- ☒ **MX** Mexico
- ☒ **NO** Norway
- ☒ **NZ** New Zealand
- ☒ **PL** Poland
- ☒ **PT** Portugal
- ☒ **RO** Romania
- ☒ **RU** Russian Federation
- ☒ **SD** Sudan
- ☒ **SE** Sweden
- ☒ **SG** Singapore
- ☒ **SI** Slovenia
- ☒ **SK** Slovakia and Utility Model
- ☒ **SL** Sierra Leone
- ☒ **TJ** Tajikistan
- ☒ **TM** Turkmenistan
- ☒ **TR** Turkey
- ☒ **TT** Trinidad and Tobago
- ☒ **UA** Ukraine
- ☒ **UG** Uganda
- ☒ **US** United States of America
- ☒ **UZ** Uzbekistan
- ☒ **VN** Viet Nam
- ☒ **YU** Yugoslavia
- ☒ **ZW** Zimbabwe

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☒ AE United Arab Emirates
- ☒ ZA South Africa
- ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 5 June 1998(05-06-98)	981286	Finland (FI)		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): 981286

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):* ISA / SE

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):* Date *(day/month/year)* Number Country *(or regional Office)*

DELETED BY RO/EI

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	:	4
description (excluding sequence listing part)	:	5
claims	:	3
abstract	:	1
drawings	:	3
sequence listing part of description	:	
Total number of sheets	:	16

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☒ separate signed power of attorney
3. ☒ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: Official Action

Figure of the drawings which should accompany the abstract: 1A and 1B

Language of filing of the international application: Finnish

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

FORSSÉN & SALOMAA OY

Mauri Herttuainen

For receiving Office use only

1. Date of actual receipt of the purported international application: 27 MAY 1999 (27-05-1999)
2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA / SE
6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau: 08 JULY 1999 (08.07.99)

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 11 January 2000 (11.01.00)	
International application No. PCT/FI99/00458	**Applicant's or agent's file reference** MH/FI981286
International filing date (day/month/year) 27 May 1999 (27.05.99)	**Priority date** (day/month/year) 05 June 1998 (05.06.98)
Applicant RAHKOMAA, Jouni et al	

1. The designated Office is hereby notified of its election made:

   [X] in the demand filed with the International Preliminary Examining Authority on:

   26 October 1999 (26.10.99)

   [ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

   [ ] was not

   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

C. Cupello

Telephone No.: (41-22) 338.83.38

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 99/00458

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21F 1/08
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG: ALLSCIENCE

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5030326 A (JEAN P. NOUS), 9 July 1991 (09.07.91), figure 2 --	1,12
A	US 3839145 A (KARL EUGEN BUECKLE), 1 October 1974 (01.10.74), figures 1,2 --	1,12

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 October 1999	08 -10- 1999
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Olov Jensén/ELY Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/08/99

International application No.
PCT/FI 99/00458

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5030326 A	09/07/91	CA 1327471 A	08/03/94
		EP 0418445 A	27/03/91
		FR 2631353 A	17/11/89
US 3839145 A	01/10/74	DE 2045920 A,B,C	23/03/72
		FR 2107699 A	05/05/72
		SE 370556 B,C	21/10/74